F/A-18 and EA-18G
Moving Toward a Networked Environment

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F/A-18 Advanced Development
June 29, 2005

Statement A: Approved for public release; distribution is unlimited

Key Messages

- Navy has invested in F/A-18E/F and EA-18G aircraft physical architecture, with AESA radar, ATFLIR pod, MIDS/JTRS and DCS radios, ALR-67(v)3, JHMCS, SHARP, GPS-weapons, and the AEA sub-system.
- These aircraft possess the necessary building blocks that will allow Navy to operate, fight, and win on a Joint, networked battlefield.

Topics

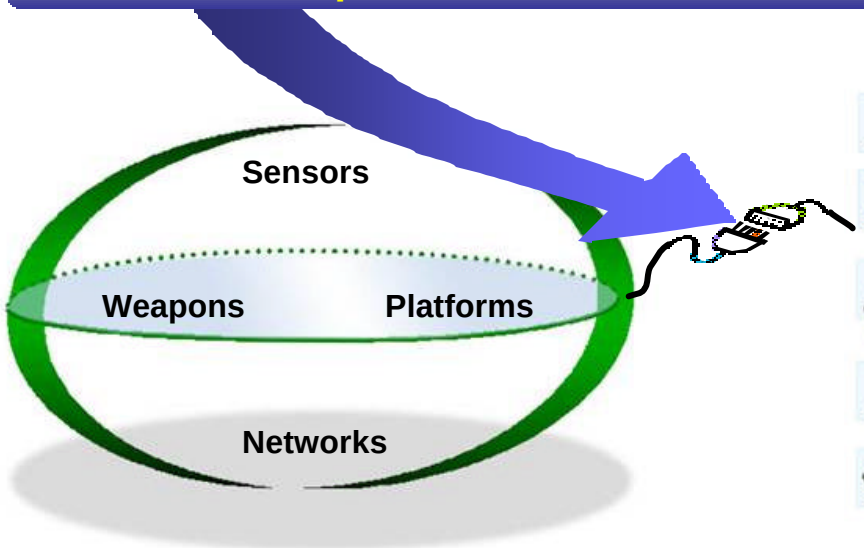
- Naval Aviation in Transition…..
- F/A-18 and EA-18G Baseline Architecture
- F/A-18 Joint Interoperability Today
- Migration towards BSN via architecture and Joint Demo's and Experiments

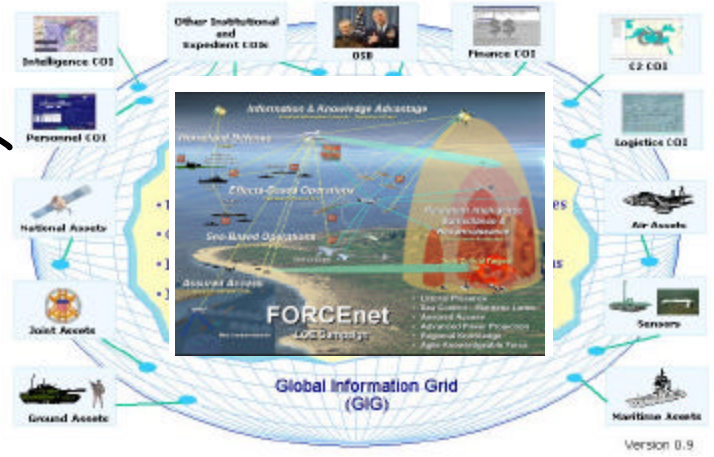
Naval Aviation in Transition....

Mission Capability Focused: Speed, Agility, & Alignment

- **We must be networked and interoperable with joint forces (MTM)**
- **We must possess the ability to move tactical war fighting information seamlessly on/off the aircraft and across a networked force**
- **We must manage at the interface**

• Information Elements	• Network Spec	• COI's and Training
• Std & Arch Implementation	• ICDs	• CONOPS

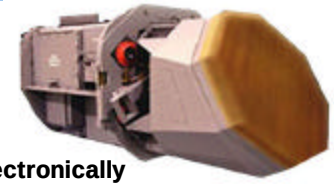




What's the future Machine-to-Machine architecture look like?

F/A-18 Integrated Architecture Roadmap

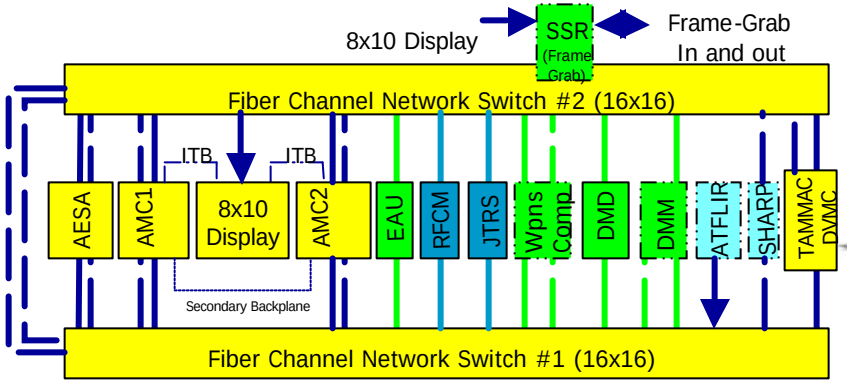
Advanced Targeting FLIR (ATFLIR)



Active Electronically Scanned Array (AESA)

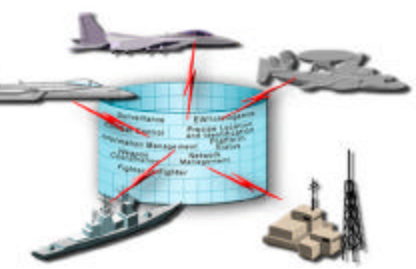
SHARED Reconnaissance POD(SHARP)

Weapons Integration



High Speed Data Network
Digital Video Network
Image Transfer BUS (ITB)
AMC-to-AMC(2nd Backplane)

Fiber Channel Architecture

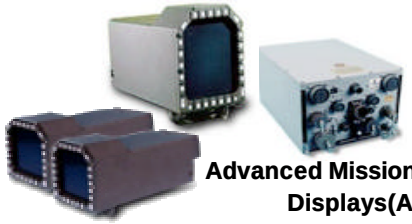


Advanced Crew Station (ACS)

Multi-Functional Information Distribution System (MIDS)

ARC210 DCS (VMF)

Joint Helmet Mounted Cueing System (JHMCS)



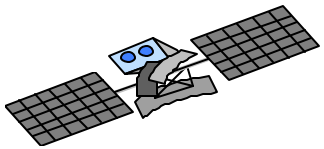
Advanced Mission Computer & Displays(AMCD)

Solid State Video Recorder (SSVR)

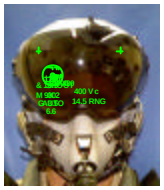
- Scalable, Portable, Flexible and Open Architecture
- Modular HOL(C++) Software Organization SEI CMM Level 5

EA-18G Architecture

MATT
- **IBS SATCOM**
- **Antenna on dorsal fin**

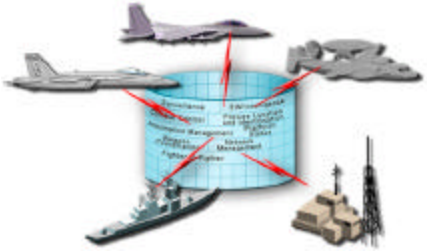


Joint Helmet Mounted Cueing System (JHMCS)

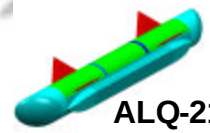


Communications Countermeasures Set
INCANS

Advanced Crew Station (ACS)



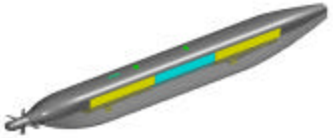
AESA



ALQ-218 v(2) Wingtip Receiver Pod

Multi-Functional Information Distribution System (MIDS)
2009/10: JTRS

ALQ-218 Radar Receiver
WRAs mounted on Gun Bay pallet



ARC210 DCS (VMF)

ALQ-99 Tactical Jamming Pods

HARM /AARGM
- **UDF download to missile**

Today's F/A-18 Interoperability Capabilities

Current F/A-18 INTEROPERABILITY = LINK-16 + VMF + CDL

Samples:

SHARP CDL (21 pods)
Wideband 274 Mbps

ARC-210/DCS Radio
VMF (K-msgs, 16 kbps)

LINK-16 (J-msgs, 28.8 – 115.2 kbps)

VOICE (HQ II / SINCGARS
/ Cipher/ J-Voice)

IFF

Tactical Data / Voice Exchange
[VHF & UHF]

LINK	Mil-Std
CDL	Mil-Std-7681990
L16	Mil-Std-6016
VMF	Mil-Std-188-220

Super Hornet E/F: Block II Aircraft Delivery : October 2005

Fighter Sweep/Escort-ASuW/MAS–Mining–Standoff Attack(Reactive & Preplanned)

Tanker - Reconnaissance-Armed Recce/SCAR

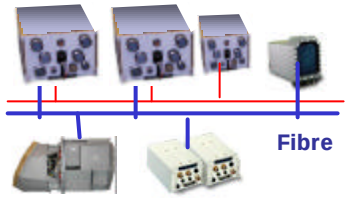
Direct Attack (Reactive & Preplanned) - SEAD

APG79·ATFLIR·ALR67·SHARP

Sensors

- AESA Standoff Radar
- ATFLIR
- ALR-67

AMC TII·FCNS·SSR



1553 Mux Flexibility

High Speed Bus Bandwidth

Architecture

- Flexible Design for Growth
- HOL S/W Easily Upgradeable
- HSDB increases digital data speed and adds digital video
- SW Dsgn Org SEI CMM Lvl 5

JSOW Unitary·JDAM·AIM-120C5·AIM9·20mm Cannon

Targeting & Strike

- Versatile Loadout
- Increased targeting accuracy with new sensors at standoff ranges in all weather

F414-GE-400

Maneuverability

- Two engines
- 9 to 1 Thrust-Weight(engine only)
- 44,000 lbs of thrust

8x10 Color·ACS·JHMCS·DVMC

In-Cockpit

- Proven Pilot Interfaces
- Helmet – Eyes Out of Cockpit
- Improved Front Seat / Back Seat configuration (ACS)
- Large 8x10 display (Aft)

Multi-Sensor Integ (Air-to-Air)
Enhanced MSI (Air-to-Ground)

Out-of-Cockpit

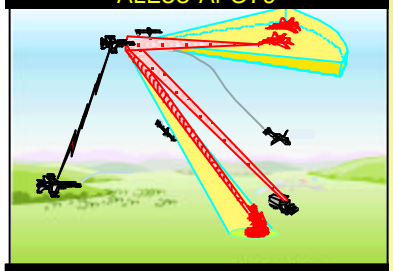
- New sensors integrated on-board and off-board inputs into a single air picture (MSI)
- Enhanced single integrated ground threat picture for aircrew (EMSI)

Link-16(MIDS)·VMF(DCS)·CIT·
·Wideband·SHARP

Fn/Connectivity

- Digital Data Communication with End User
  - Tasking
  - Imagery (EO/IR and SAR)
  - BDA

ALR67(V3)·ALE47·ALQ214·
ALE55·APG79

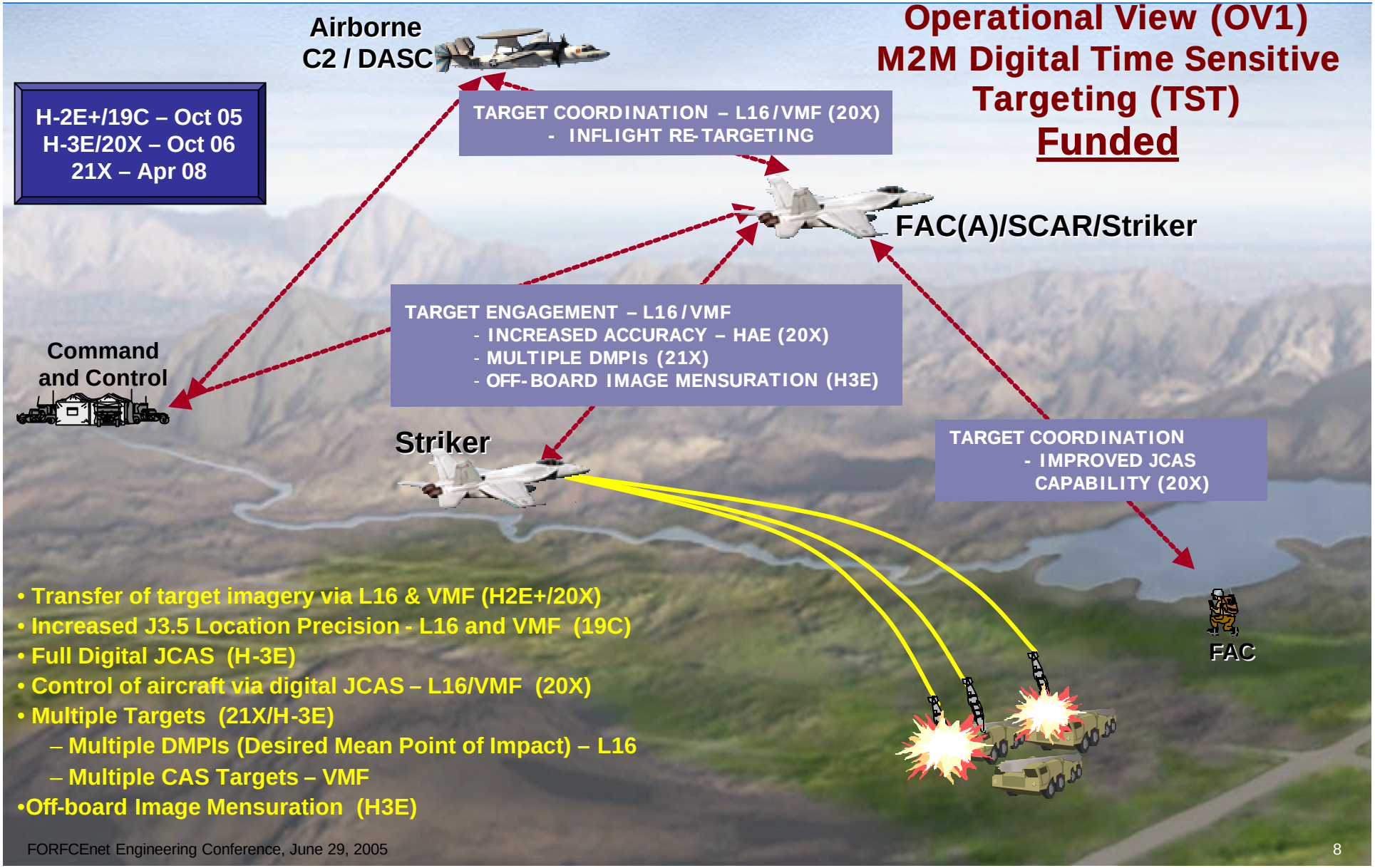


Survivability

- ALR-67 (V3) IDECM Block III provides integrated Electronic Warfare Countermeasures
- EA/EP provided by AESA

NAVAIR

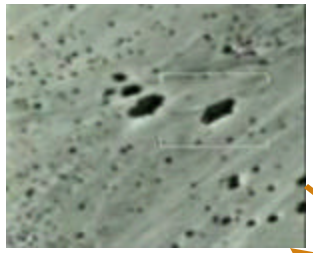
F/A-18E/F and F/A-18C/D Configured With Link 16 and DCS Radio



Demonstrated F/A-18 Experiment @ JEFX-04

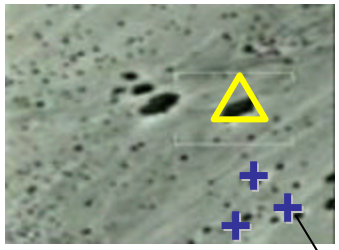
Find | **Fix** | **Track** | **Target/Engage** | **Assess**

First Tactical A/G Digital Connection Between C2 & A/C, Wpns, Sensor Node
- BFSA
- Imagery
- Real Time BDA



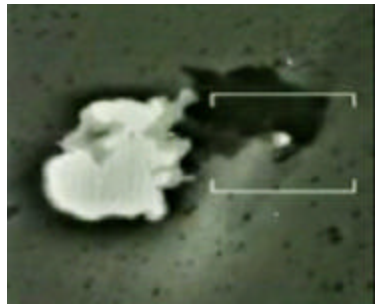
3) F/A-18 Sends ATFLIR Image to CAOC (J16.0)

Link 16



Link 16

6) F/A-18 Attacks and sends BHA ATFLIR Image to CAOC (J16.0)



Link 16

RAIDER

5) CAOC Tasks F/A-18 to Attack and Provides Blue Force SA (J12, J16, J3.5)

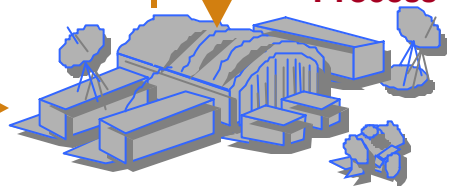
SOF

1) Cueing of possible mobile scud launcher

2) CAOC Tasks F/A-18 to Investigate Contact via L16 (J12.0)

LAN

4) Internal CAOC TGT Decision Process



CFACC / CAOC

CAOC indicated Blue Force Location on original AFTLIR image (X symbols)as well as intended target (Triangle symbol)

** Simulated ATFLIR imagery shown to keep slide unclass (Actual JEFX ATFLIR images are classified)

Digital Close Air Support
(Army Fort Dix Sep 04 Demonstration)

1. FAC Sends CAS 9-Line Tasking

2. ATFLIR Target Image Sent to FAC

5. A/C Sends BHA Image

UHF - VMF

IP

Contact Point

3. FAC Annotates Image w/ Target and BFSA

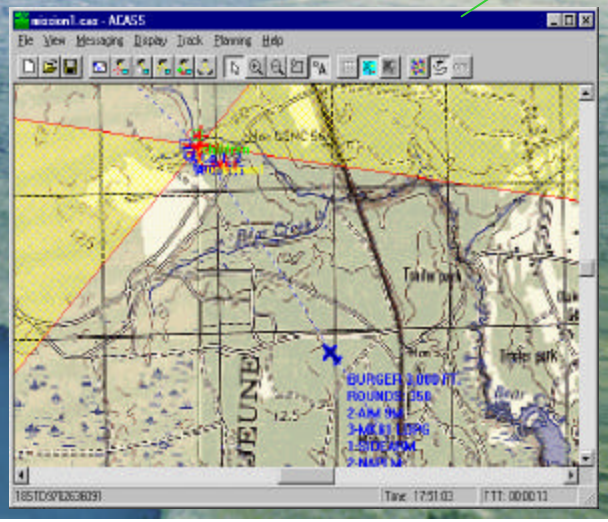
Forward Air Controller

4. FAC Directs the Attack and Monitors A/C Position and Target Designation

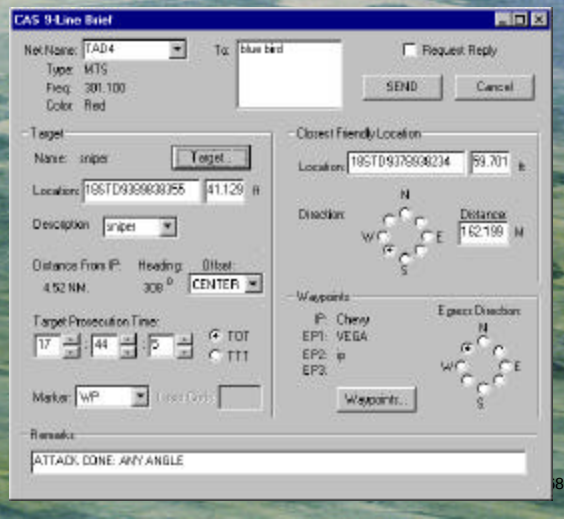
ACASS Ground System

ATFLIR image Annotated by FAC

FAC Display Showing A/C Location and Sensor Point of Interest

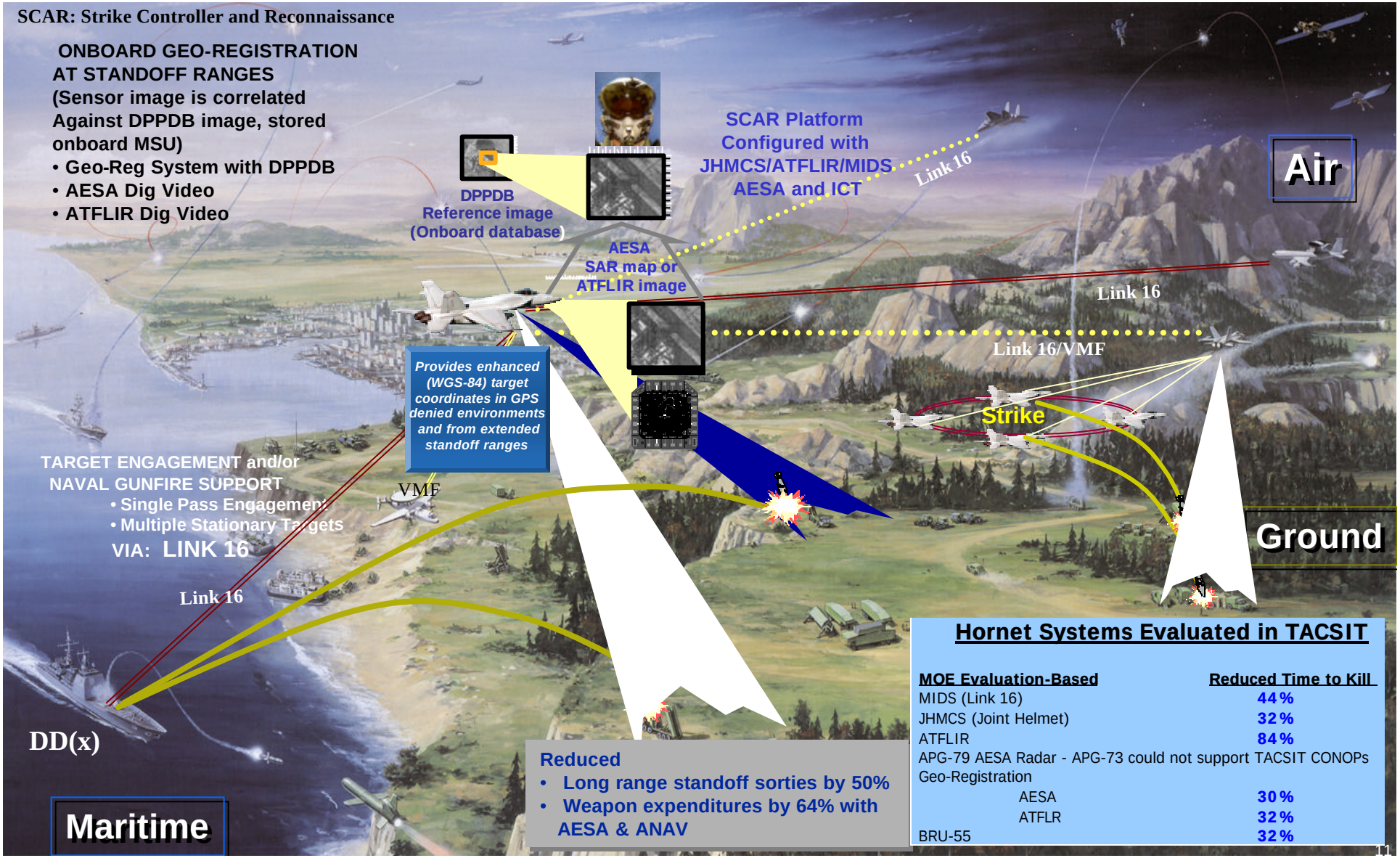


FAC 9-line Display to Populate 9-Line Message



Distributed Targeting Reduces the Kill Chain Timeline SCAR Mission in MCO2

OV1



Hornet Systems Evaluated in TACSIT

MOE Evaluation-Based	Reduced Time to Kill
MIDS (Link 16)	44%
JHMCS (Joint Helmet)	32%
ATFLIR	84%
APG-79 AESA Radar - APG-73 could not support TACSIT CONOPs	
Geo-Registration	
AESA	30%
ATFLR	32%
BRU-55	32%

Super Hornet E/F: Block – Future

Battlespace Network Capable

Fighter Sweep/Escort-ASuW/MAS–Mining–Standoff Attack(Reactive & Preplanned)

Tanker - Reconnaissance-Armed Recce/SCAR

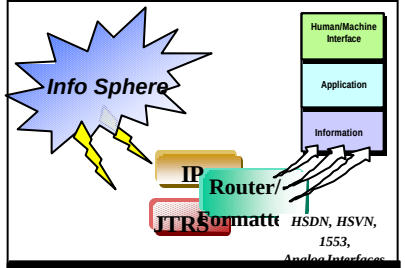
Direct Attack (Reactive & Preplanned) - SEAD

APG79·ATFLIR·ALR67·SHARP

Sensors

- AESA Standoff Radar
- ATFLIR
- ALR-67
- ANAV – Accurate Nav

SARM·IP Router·AMC TIII·



Architecture

- Open System Architecture
- IP Interface to Network
- Wideband / High Speed
- HOL S/W Upgraded

JCM·JASSM·JSOW·JDAM·AIM-120C·AIM9·20mm Cannon

Targeting & Strike

- Versatile Loadout
- Increased targeting accuracy with precision target/imagery geo-registration
- Moving Targets

F414-GE-400

Maneuverability

- Two engines
- 9 to 1 Thrust-Weight(engine only)
- 44,000 lbs of thrust

8x10 Color·ACS·JHMCS·DVMC

In-Cockpit

- Proven Pilot Interfaces
- Helmet – Eyes Out of Cockpit
- Improved Front Seat / Back Seat configuration (ACS)
- Large 8x10 display (Aft)

Multi-Sensor Integ (Air-to-Air)
Enhanced MSI (Air-to-Ground)

Out-of-Cockpit

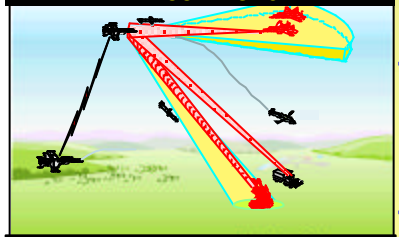
- Fully Integrated Airborne – Ground – Threat Representation
- Cooperative Targeting
- Integrated Blue Force Tracking
- Combat ID
- Integrated w/ Offboard Sensors

Link-16(MIDS)·VMF(DCS)·CIT·
JTRS Wideband -SHARP

Fn/Connectivity

- Digital Data Communication with End User
  - Wideband Network
  - Tasking
  - C^2 Contributor
  - Precision Target/Imagery
  - BDA/Maintenance

ALR67(V3)·ALE47·ALQ214·
ALE55·APG79



Survivability

- ALR-67 (V3) IDECM provides integrated Electronic Warfare Countermeasures
- EA/EP provided by AESA func.
- AESA integrated w/ IDECM

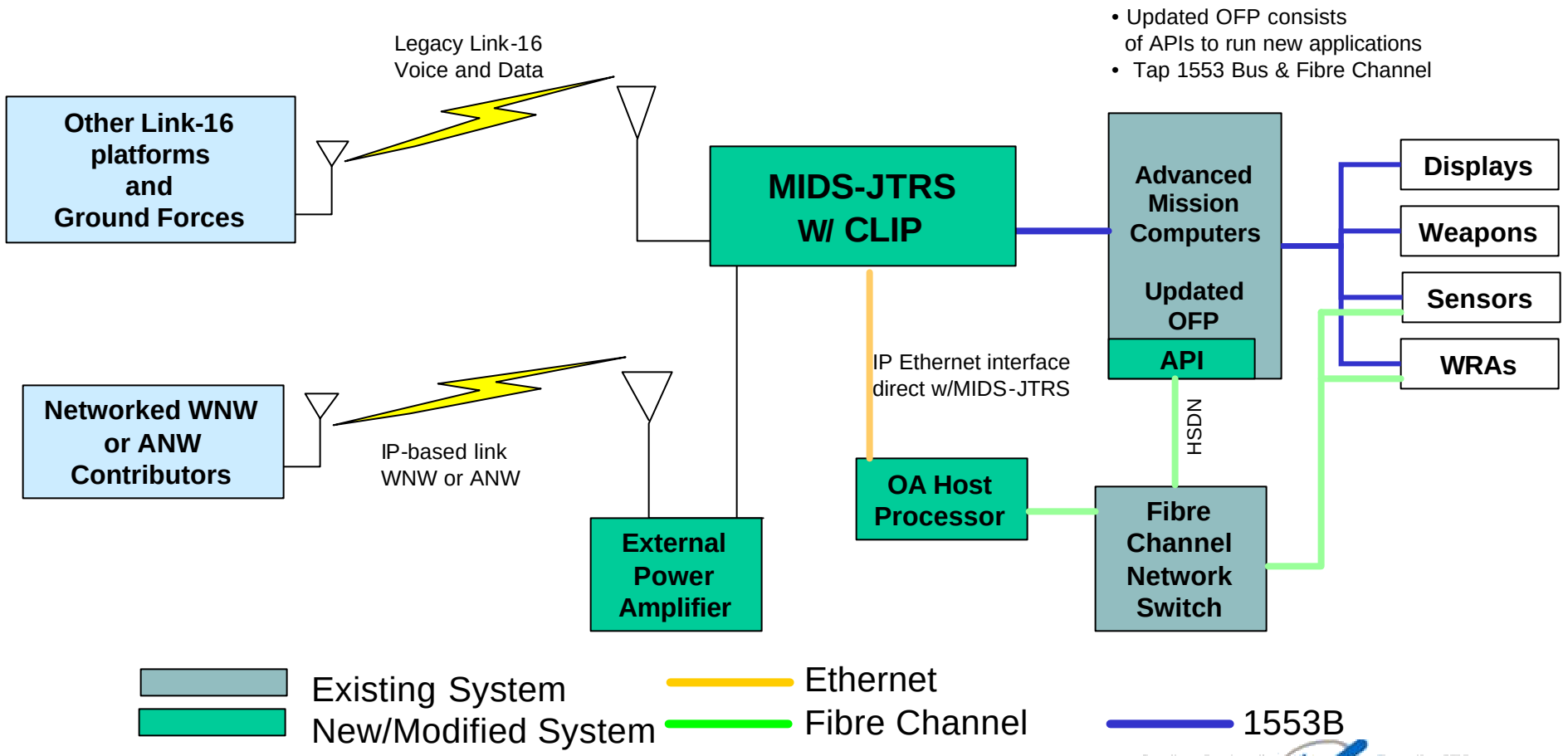
NAVAIR

F/A-18E/F & EA-18G
Architectural Considerations for BSN

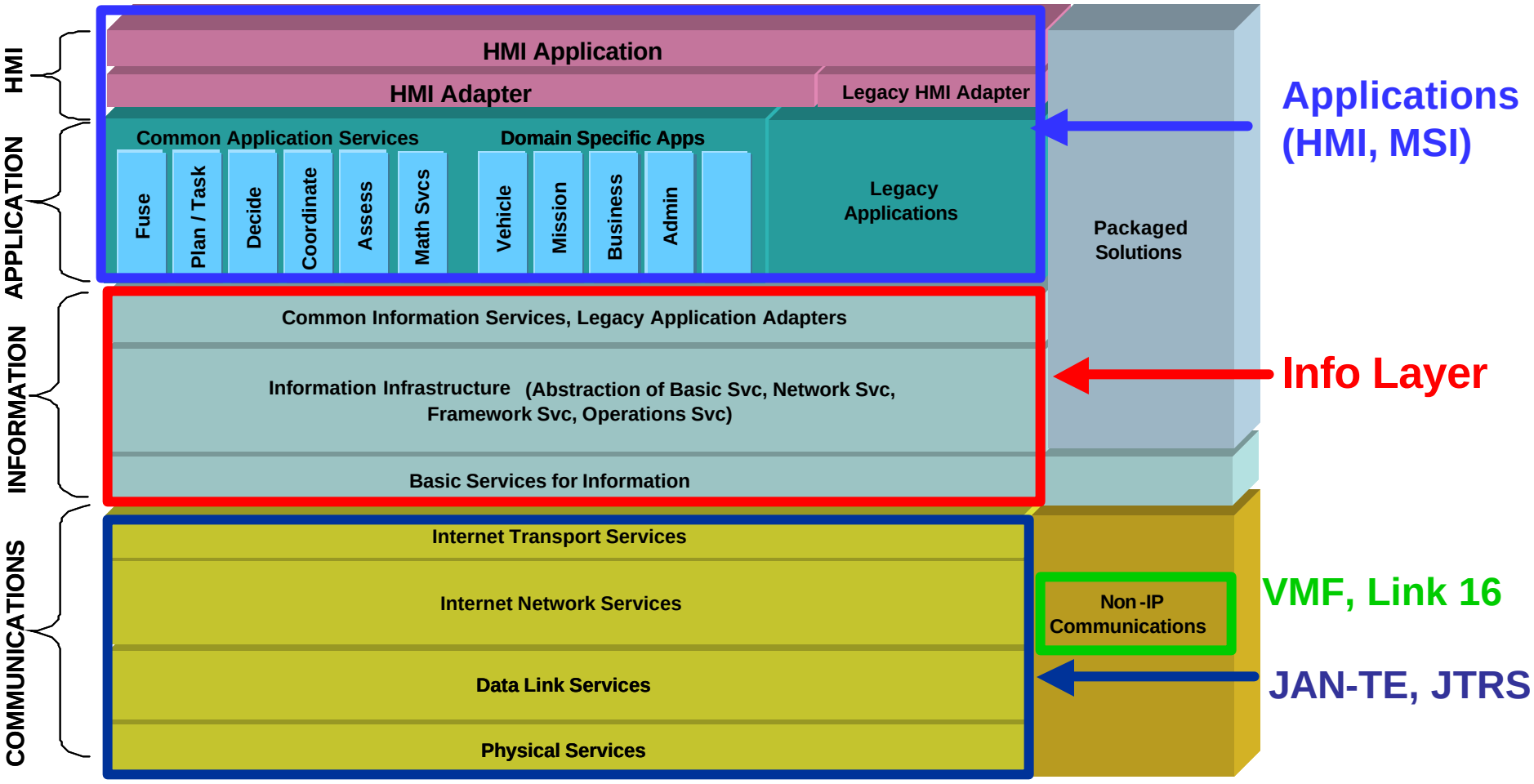
- Software integration
  - Alternatives to accommodate exchange of IP-based information
    - Open systems computing environment
    - Separation of network services and applications from OFP in Advanced Mission Computer (AMC)
  - Bus architecture
    - Network portal issues between airborne network & platform Local Area Network (LAN)
    - High-speed data bus options
- Power and cooling requirements
- Space and weight
- RF architecture
  - Antenna impacts in & out of L-band
  - External power amplifier
  - Co-site interference (EMI/EMC)
- Software loading tools and mission planning systems impacts
- Identification of EA-18G unique requirements

Potential TACAIR Architecture F/A-18E/F and EA-18G "Smart Node"

F/A-18E/F, EA-18G "Smart Node" Example



What it Takes to Exploit an IP Network



Full Capability of a System is Only Realized When All Layers of the Architecture are Integrated for NCO

F/A-18F(F1) Advanced Technology Demonstrator

EMD Aircraft F/A-18F Cum 1 (F1)

– Onsite STL Oct 2001

Managed and Maintained by Boeing

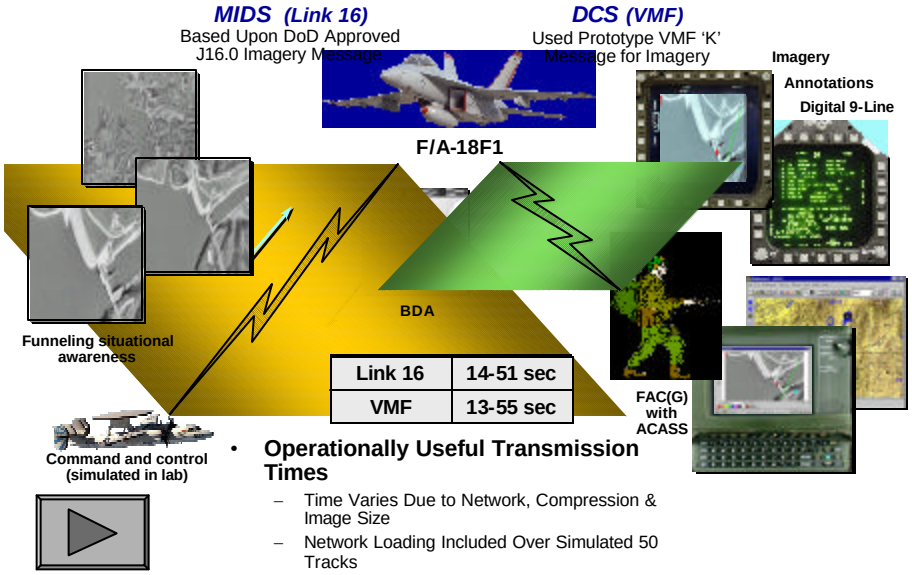
– 5 yr Cooperative Agreement with NAVAIR

Demo/Experimentation, Technology Transition & Rapid Deployment Capability (RDC)

F/A-18F Cum 1 (F1)

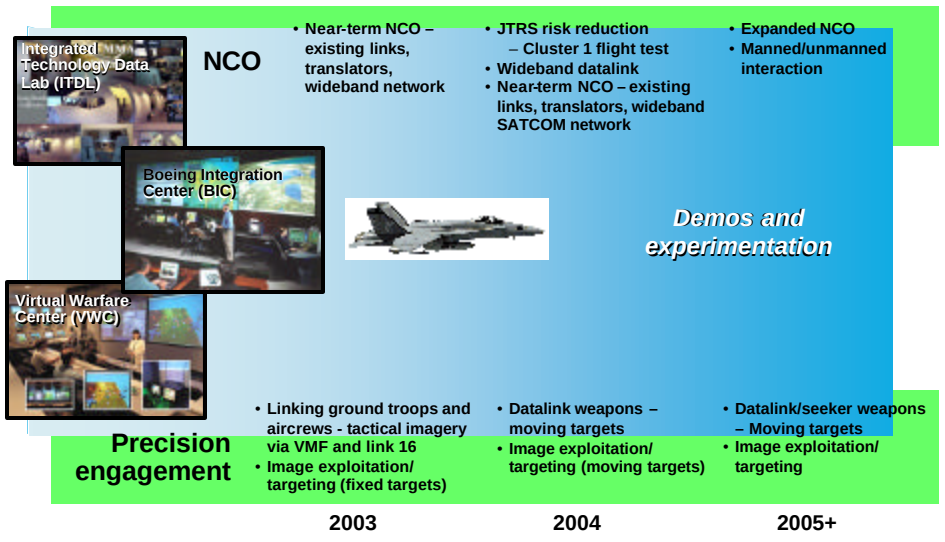
Link 16 and VMF Imagery with Digital CAS

Demonstrated 4 Sept, 2003 St. Louis Area



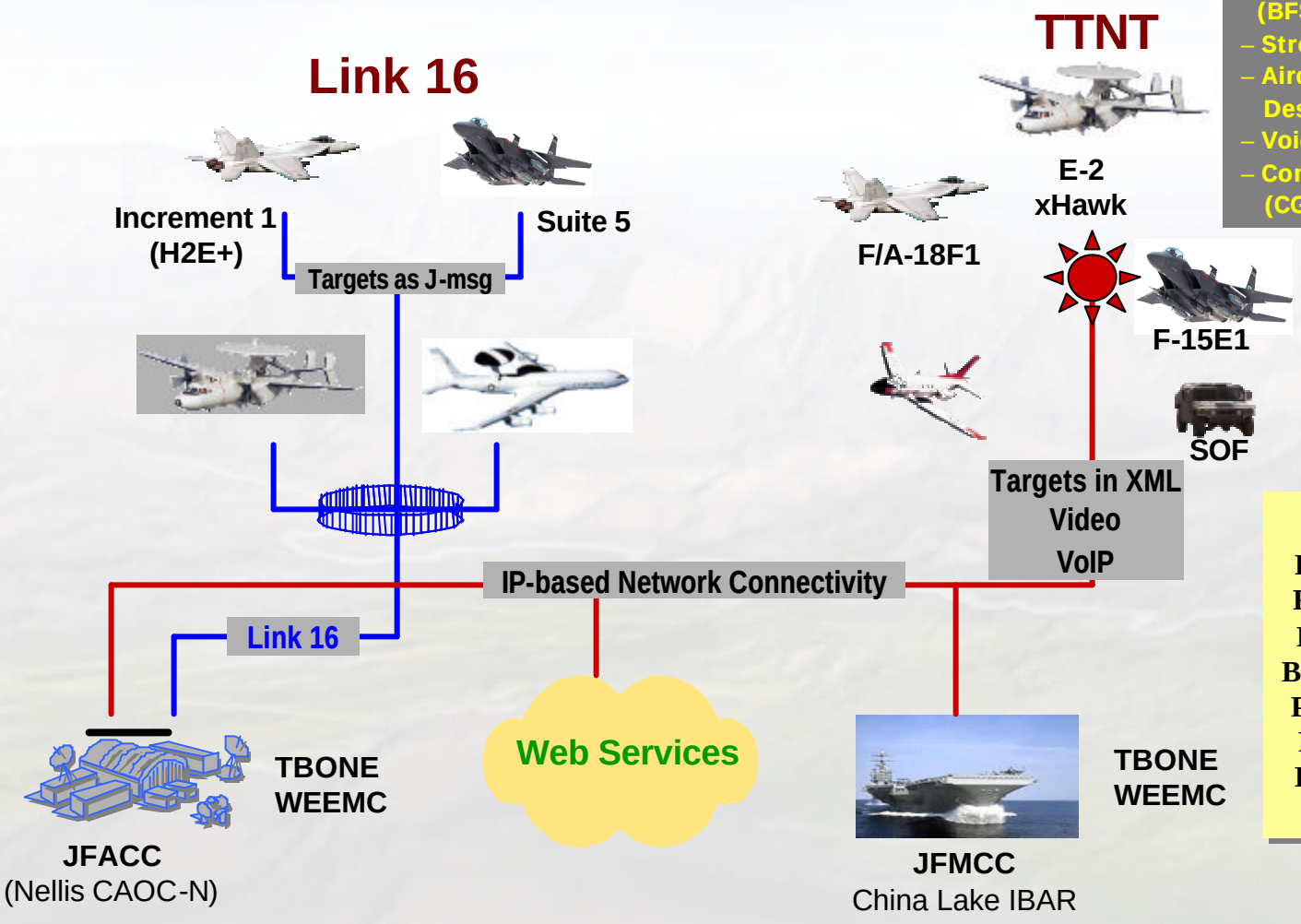
- **Operationally Useful Transmission Times**
  - Time Varies Due to Network, Compression & Image Size
  - Network Loading Included Over Simulated 50 Tracks

Net-Centric: Capability Now . . . Focused on Growth



JEFX06 Architecture
(April 2006)

Goals and Objectives
- –Target Data Package
- – Own-ship Heartbeat / Status Message
- – Imagery with Annotations
- – Blue Force Situational Awareness (BFSA)
- – Streaming Video
- – Aircraft's "Ground Target Designation"
- – Voice over IP (VoIP)
- – Common Grid Reference System (CGRS) Message



JEFX06 Force List
F/A-22, F-15C, F-16, F-15E F-16C+, F-16C, F-15E(E1), F/A-18(F1), F-117, EA-6B, B-1/2/52, E-3B, TS-3, RC-135 PR-707, E-8, E-2C(x-Hawk) Predator, GH, BACN A/C, EC-130H, A/OA-10, HH-60 MC-130, AC-130, KC-130

F/A-18E/F and EA-18G
Battle Space Networking Roadmap

FY05 FY06 FY07 FY08 FY09 FY10 FY11 FY12

COTS Based AMC&D/FCNS
Fielded

AMCT3(COTS)
PMA Funded

IP Processor (COTS)
Open Architecture Hardware

Communication Infrastructure
Design&Development | *Integration and Tests* | *Fielding*

Open Architecture Software, HOL(C++)
PMA Funded | *Application S/W Integration*

Advanced Mission Computer and Displays
COTS Computing – Common OFP Baseline
High Order Language, OOD
Open System Software Environment (DTE)
Rapid Deployment Capability

Capabilities
BFSA – MTM

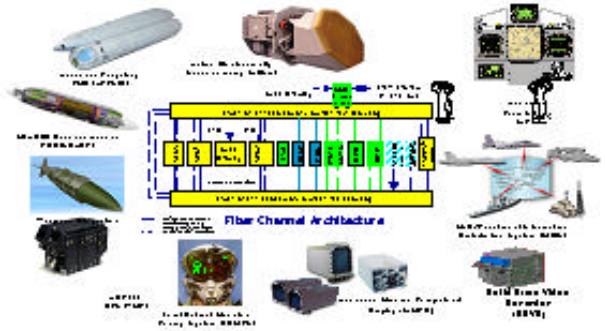
Integration and Test Conducted on F/A-18E/F and EA-18G Platform Leading to Full Capability

AMC OFP Upgrade
Requirements Definition | *Design/Code/Test* | *Integeration&Test*

HOL H5E/H7E
Software Requirements | *Design/Code/Test* | *Integ Test* | *Full Weapon System Testing*

JTRS
Migration Plan Dev | *Risk Reduction* | *Design/Code* | *Navy/Prime SIL Integration & Test* | *ACFT Testing* | *OT*

F/A-18 & EA-18G Integrated Architecture



Geo-Registration/ICT/Distributed Targeting(Open Arch)
F/A-18E/F LOT 30

BSN Capability

Delivery Date

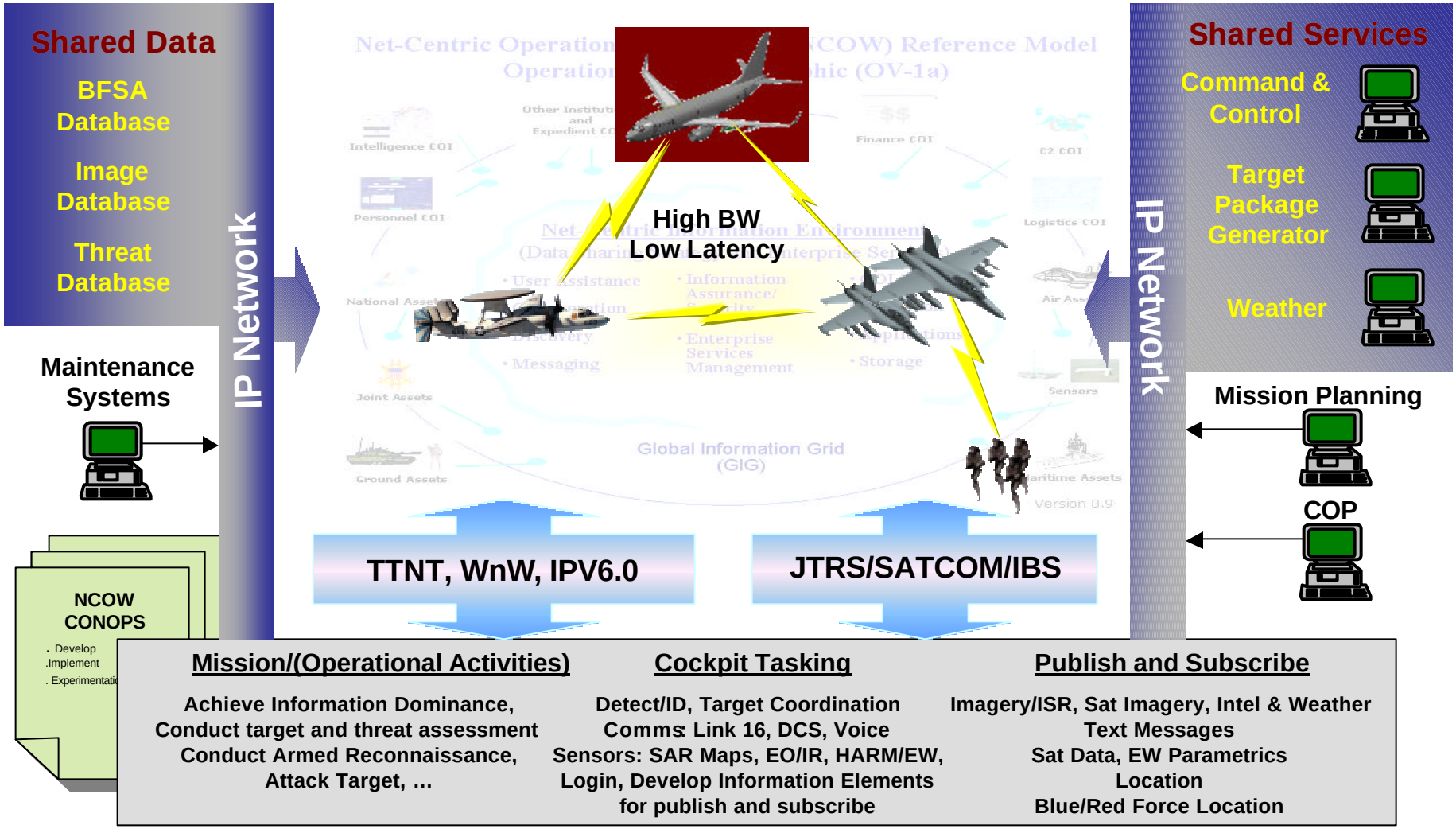
LOT 29 | LOT 30 | LOT 31 | LOT 32 | LOT 33 | LOT 34

F/A-18E/F and EA-18G Baseline Architecture

Current Efforts
Future Planned Efforts

MIDS JTRS JAN-TE WAVEFORM
IPv6 Wide Band Networks (OV1)

Full Network Centric Operations and Warfare



Questions?

"We will adapt to the changing world around us by getting out in front of it, by leading change, and embracing the innovations and improvements needed to guarantee our future success……."

- CNO (CNO Guidance 2004)

Backup

Link 16 and VMF Imagery with Digital CAS

Demonstrated 4 Sept, 2003 St. Louis Area